



(11) **EP 1 236 826 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.09.2002 Bulletin 2002/36

(51) Int Cl.7: **D06F 58/28**

(21) Application number: 02003232.2

(22) Date of filing: 20.02.2002

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
 MC NL PT SE TR**
 Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 02.03.2001 DE 10110165
12.01.2002 DE 10200975

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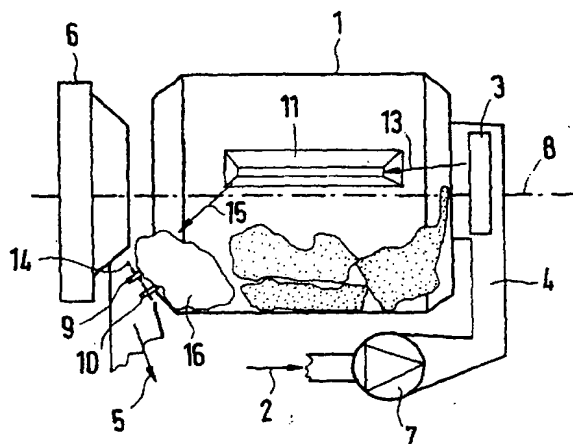
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(54) **A method for changing the program cycle of a household dryer**

(57) The invention relates to a method for changing the program cycle of a household dryer while drying laundry, wherein the program can be changed and cancelled depending on the moisture of the laundry and the elapsed time of the selected program, wherein the laundry come into contact with moisture sensors during the drying process that measure the contact frequency and moisture of the laundry and provide measured values for changing the program, indicating the remaining drying time and canceling the initiated program. If it is provided according to the invention that the moisture sensors are attached to lateral grids provided between door and laundry drum at a level above the lowest point of the laundry drum, that the moisture sensors determine the time intervals between the individual contacts with predetermined minimum moisture and that these time intervals are used to calculate statistical means, and that the changes of the program parameters, the display of the remaining drying time and the shut-off of the program are calculated based on the statistical means of the time intervals determined in this way, then a method is obtained with simple sensor and circuit configuration that uses the load volume of the laundry with sufficient accuracy to change the program cycle and to derive the display of the remaining drying time.



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Description

[0001] The invention relates to a method for changing the program cycle of a household dryer while drying laundry, wherein the program can be changed and canceled depending on the moisture of the laundry and the elapsed time of the selected program, wherein the laundry comes into contact with moisture sensors during the drying process, which moisture sensors measure the contact frequency and moisture of the laundry and provide measured values for changing the program, indicating the remaining drying time and canceling shutting off the initiated program.

[0002] Such methods are known from DE 197 36 422 A1 and DE 29 45 696 C2. In these patents, the moisture sensors are disposed in the laundry drum and perform the same revolution. The measurement for the load volume is derived from the frequency of the conductance measuring signals and processed in digital form.

[0003] With this disposition of the moisture sensors and the measurement of the conductance, laundry will constantly be in contact with the moisture sensors, even if the load is small. This means that a proportionate measurement of the loaded laundry volume is almost impossible, which does not provide sufficiently unambiguous results, especially, if the measured result changes the program cycle, so as to display the remaining drying time and to shut off the household dryer.

[0004] As shown in DE 198 02 616 A1, a specific laundry parameter can be taken from the laundry after it was removed from the washer, that can be used to select the drying program when the laundry is placed in the dryer. This method is very cumbersome.

[0005] Another method keeps - after the start - at least three widely divergent measurement variables, such as electrical laundry resistance, time characteristic of the temperature at the loading side of the drum, temperature differences/temperature increase at the loading side of the drum in a fixed time frame, ambient temperature to determine the expected drying time of a dryer. This method requires complex sensor and analysis work.

[0006] The object of the invention is to provide a method of the kind indicated in the preamble that uses simple sensor and circuit configuration to obtain a measuring value for a large range of the laundry load, which measured value can be used with satisfactory reproducibility to change the program cycle, display the remaining drying time and shut off the household dryer.

[0007] According to the invention, this objective is achieved in that the moisture sensors are attached to lateral grids provided at a level above the lowest point of the laundry drum between door and laundry drum, that the time intervals between the individual contacts with pre-determined minimum moisture are recorded by the moisture sensors and that these time intervals are used to calculated statistical means, and that the changes of the program parameters, the display of the remain-

ing drying time and the shut-off of the program are calculated based on the statistical means of the time intervals calculated in this way.

[0008] The moisture sensors are disposed outside of the laundry drum and attached to the slanted grid between the door and the laundry drum and are configured in a position to the lowest point of the laundry drum, which is higher. The result of this positioning is that the more frequently pieces of laundry fall laterally on the grid and slide over it, the larger the load volume of laundry. The laundry contacts with the moisture sensors increase in proportion to the load volume. The statistically derived means of the time intervals of the contacts result in uniquely distinguishable and evaluable measurement variables for changing the program cycle, deriving the display for the remaining drying time and shutting-off the household dryer. This method results in a significantly more informational determination of frequency and thus in a more accurate method.

[0009] One embodiment may provide that - when the machine is switched on - the initial values for the drying cycle are preset by an experimentally determined, designated standard program preset by the user's program selection and device-specific options (such as dryness, cool-down cycle, wrinkle protection).

[0010] The drying cycle can be initiated with this start program, and then it can be determined that the intervals between the individual contacts with the preset minimum moisture is detected only after the preset time after the program start. The recorded statistical means of the time intervals of the individual contacts is used as a measure for the load volume.

[0011] The measurement can be performed such that the measured values of the moisture sensors are determined continuously or in intervals and the allocated remaining drying time is displayed accordingly.

[0012] For a timely shut-off of the household dryer with the desired remaining moisture of the laundry it can be provided that the remaining moisture of the laundry is measured after a pre-set part of the program cycle time and/or compared with the selected final degree of dryness. The household dryer can be shut off if both values match.

[0013] The same result can be achieved by starting a cool-down process if the statistical mean is lacking and by the household dryer shutting off after completion of the cool-down process.

[0014] The method can be further improved such that the recorded measured values of the moisture sensors are taken into consideration depending on the different fabric types of the loaded laundry with differing weights for changing the program cycle time, whereas the fabric types can be pre-set via the program settings.

[0015] The functioning of the method according to the invention will be explained in more detail with reference to a household dryer shown in the drawing.

[0016] During the drying cycle, laundry drum 1 is rotated around an axis 8. Arrow 2 symbolizes an air cur-

rent that is generated by means of a blower 7 and is guided in an air channel 4 via a heater 3 into the laundry drum 1. The laundry drum 1 is filled with laundry items 16 that are carried by blades 11 that repeatedly drop them into the bottom area of the laundry drum 1. In the bottom area facing the door 6, a grid 14 transitions into the outgoing air channel as shown by the arrow 5.

[0017] The heated air 13 passes into the interior of the laundry drum 1, removes moisture from the moist laundry, and, as shown by the arrow 15, exits the laundry drum 1 via the grid 14. The grid 14 is disposed between the door 6 and the laundry drum 1 and is equipped with two moisture sensors 9 and 10 at a distance from each other. The laundry items 16 falling in the laundry drum 1 are guided increasingly over grid 14 on moisture sensors 9 and 10 - depending on the laundry load - which moisture sensors are used as electrodes to measure resistance, and the laundry falls back into the laundry drum 1. The connection via the laundry items 16 must fall below a resistance value that is determined by the minimum moisture of the laundry item 16. Only then is the contact with the moisture sensors registered and used to change the program cycle time. If the frequency of these contacts increases, then there are more laundry items 16 in the laundry drum 1, and the larger load determined in this manner can be taken into account in the program cycle. The preset resistance value and hence the preset minimum moisture can vary depending on the program selection and specific user settings and is contained in the initial value of the designated, experimentally determined standard program, whereas the program cycle is also preset in the standard program, and is changed after a preset time for example, after a few minutes depending on the measured values determined by the moisture sensors. This procedure can be repeated at further intervals.

[0018] The moisture sensors 9 and 10 are connected with an evaluation circuit in the program control and can thus act directly upon it. The number of times the laundry items 16 contact the moisture sensors 9 and 10 are counted, but only have an effect when the required minimum moisture is measured. The progress of the drying cycle is accordingly monitored and changed, whereby the weighting of the change can be dependent on the selected program.

[0019] The absolute moisture can be measured after a preset part of the overall program cycle time and compared with a desired degree of drying which the user presets when selecting the program. When the degree of drying is reached, the drying cycle can also be terminated prematurely, and the cooling down and shutting off process of the household dryer can be started.

[0020] To inform the user of the expected operating time of the household dryer, the program cycle time of the designated standard program is displayed at the beginning of the drying cycle and is correspondingly changed when changes in the cycle time occur. Thus, the user is constantly informed about the program cycle

time at the beginning and after the changes occur.

[0021] The intervals between the individual contacts of moisture sensors 9 and 10 are measured in the evaluation circuit that is downstream of moisture sensors 9 and 10, and a statistical mean per interval is derived. The course of this statistical mean is almost proportionate to the laundry load, which means that the statistical mean can be used to a large extent as a measurement variable for the change of the program cycle, the derivation of the display of the remaining drying time and the shut-off of the household dryer.

Claims

1. A method for changing the program cycle of a household dryer while drying laundry, wherein the program can be changed and cancelled depending on the moisture of the laundry and the elapsed time of the program, wherein the laundry comes into contact with moisture sensors during the drying process, said moisture sensors record the contact frequency and moisture of the laundry and provide measured values for changing the program, displaying the remaining drying time and canceling the initiated program,
characterized in that
 moisture sensors (9, 10) are attached to lateral grids (14) provided between door (6) and laundry drum (1) at a level above the lowest point of the laundry drum (1),
 that moisture sensors (9, 10) can determine the intervals between the individual contacts with pre-set minimum moisture from which the statistical means can be derived, and
 that the statistical means of the intervals that were obtained can be used to derive the changes of the program parameters, the display of the remaining drying time and the shut-off of the program.
2. A method according to Claim 1,
characterized in that
 at program start, the initial values for the drying cycle are preset by an experimentally determined, designated standard program preset by the user's program selection and device-specific options (such as dryness, cool-down cycle, wrinkle protection).
3. A method according to Claims 1 or 2,
characterized in that
 the intervals of the individual contacts with the pre-set minimum moisture are only determined after a pre-set time after program start (for instance a couple of minutes) via the moisture sensors (9, 10).
4. A method according to Claims 1 to 3,
characterized in that

the determined statistical mean is used as a measure for the load of the laundry drum (1).

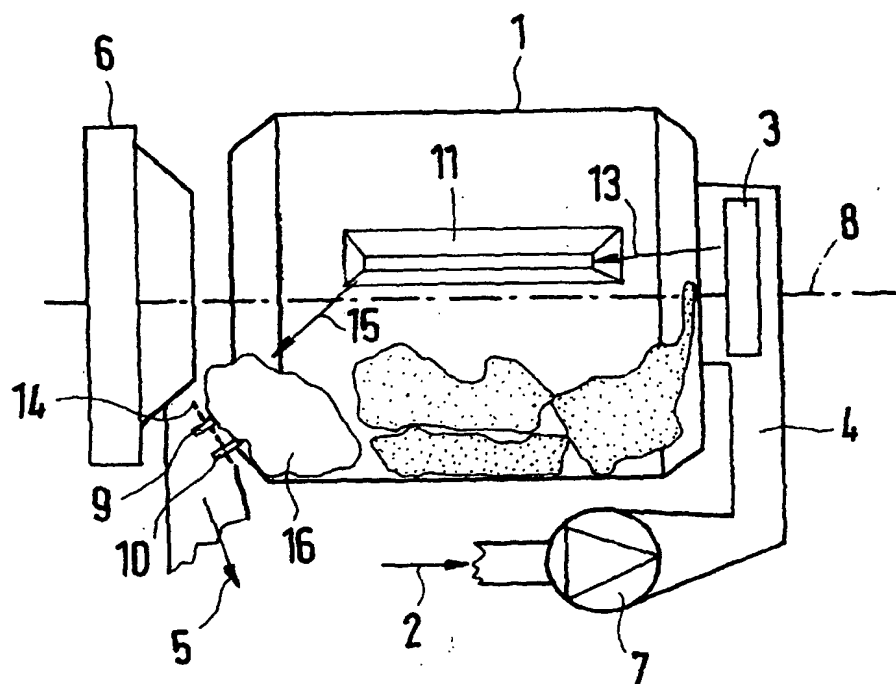
5. A method according to Claims 1 to 4,
characterized in that 5
the first change of the pre-set standard program is made after a time that has been or can be pre-set (for instance 10 to 20 minutes) after the start of the drying cycle.
6. A method according to Claims 1 to 5,
characterized in that 10
the measured values of the moisture sensors (9, 10) can be determined continuously or in intervals and the allocated remaining drying time is displayed accordingly. 15
7. A method according to Claims 1 to 6,
characterized in that 20
after the pre-set portion (for instance 75 to 90%) of the program cycle time has elapsed, the remaining moisture of the laundry is measured and compared to a desired and/or selected final level of dryness.
8. A method according to Claims 1 to 7,
characterized in that 25
a cool-down cycle is started, if the statistical mean is lacking, and
the household dryer is shut off after the cool-down cycle is completed. 30
9. A method according to Claims 1 to 8,
characterized in that
the determined measured values of the moisture sensors (9, 10) are weighted differently depending 35
on the different types of fabric in the laundry load (16), wherein the said fabric types are preset by the program settings.

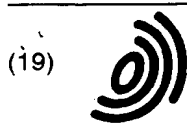
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(11) **EP 1 236 826 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
01.10.2003 Bulletin 2003/40

(51) Int Cl.7: **D06F 58/28**

(43) Date of publication A2:
04.09.2002 Bulletin 2002/36

(21) Application number: **02003232.2**

(22) Date of filing: **20.02.2002**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **02.03.2001 DE 10110165**
12.01.2002 DE 10200975

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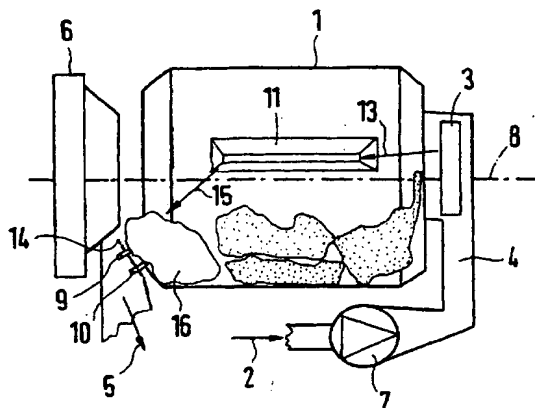
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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 02 00 3232

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Place of search MUNICH		Date of completion of the search 11 August 2003	Examiner Falkentoft, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.02 (P04C01)

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EP 02 00 3232

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